2002 Spring Meeting
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HR: 10:35h
AN: **P51A-08**
TI: **Technology Development and Advanced Planning for Curation of Returned Mars Samples**
AU: * **Lindstrom, D J**
EM: *david.j.lindstrom1@jsc.nasa.gov*
AF: *NASA Johnson Space Center, Mail Code ST, Houston, TX 77058*
AU: **Allen, C C**
EM: *carlton.c.allen1@jsc.nasa.gov*
AF: *NASA Johnson Space Center, Mail Code ST, Houston, TX 77058*
AB: NASA/Johnson Space Center (JSC) curates extraterrestrial samples, providing the international science community with lunar rock and soil returned by the Apollo astronauts, meteorites collected in Antarctica, cosmic dust collected in the stratosphere, and hardware exposed to the space environment. Curation comprises initial characterization of new samples, preparation and allocation of samples for research, and clean, secure long-term storage. The foundations of this effort are the specialized cleanrooms (class 10 to 10,000) for each of the four types of materials, the supporting facilities, and the people, many of whom have been doing detailed work in clean environments for decades. JSC is also preparing to curate the next generation of extraterrestrial samples. These include samples collected from the solar wind, a comet, and an asteroid. Early planning and R\&D are underway to support post-mission sample handling and curation of samples returned from Mars. One of the strong scientific reasons for returning samples from Mars is to search for evidence of current or past life in the samples. Because of the remote possibility that the samples may contain life forms that are hazardous to the terrestrial biosphere, the National Research Council has recommended that all samples returned from Mars be kept under strict biological containment until tests show that they can safely be released to other laboratories. It is possible that Mars samples may contain only scarce or subtle traces of life or prebiotic chemistry that could readily be overwhelmed by terrestrial contamination. Thus, the facilities used to contain, process, and analyze samples from Mars must have a combination of high-level biocontainment and organic / inorganic chemical cleanliness that is unprecedented. JSC has been conducting feasibility studies and developing designs for a sample receiving facility that would offer biocontainment at least the equivalent of current maximum containment BSL-4 (BioSafety Level 4) laboratories, while simultaneously maintaining cleanliness levels equaling those of state-of-the-art cleanrooms. Unique requirements for the processing of Mars samples have inspired a program to develop handling techniques that are much more precise and reliable than the approach (currently used for lunar samples) of employing gloved human hands in nitrogen-filled gloveboxes. Individual samples from Mars are expected to be much smaller than lunar samples, the total mass of samples returned by each mission being 0.5- 1 kg, compared with many tens of kg of lunar samples returned by each of the six Apollo missions. Smaller samples require much more of the processing to be done under microscopic observation. In addition, the requirements for cleanliness and high-level containment would be difficult to satisfy while using traditional gloveboxes. JSC has constructed a laboratory to test concepts and technologies important to future sample curation. The Advanced Curation Laboratory includes a new-generation glovebox equipped with a robotic arm to evaluate the usability of robotic and teleoperated systems to perform curatorial tasks. The laboratory also contains equipment for precision cleaning and the measurement of trace organic contamination.
DE: 6215 Extraterrestrial materials